

REMARKS

By the present amendment, independent claim 1 has been amended to further clarify the concepts of the present invention. More particularly, claim 1 has been amended to recite that the processing aid for thermoplastic resin as presently claimed is obtained by emulsion-polymerizing a composition which consists essentially of the recited components. Entry of these amendments is respectfully requested.

In the Office Action, claims 1, 3 and 6 were rejected under 35 USC § 102(b) as being anticipated by the patent to Orikasa et al. In making this rejection, it was asserted that the cited patent teaches a composition which is obtained from a multi-step polymerization of (1) glycidyl methacrylate and (2) methyl methacrylate in the presence of (3) an initiator having a t-butyl peroxy group. In so doing, it apparently was asserted that (1) is the same as the (meth)acrylate having an oxygen atom in addition to an ester bond as recited in claim 1, (2) is the same as another alkyl acrylate as recited, and (3) is the same as the polymerization initiator as recited. Reconsideration of this rejection in view of the above claim amendments and the following comments is respectfully requested.

Before discussing the rejection in detail, a brief review of the presently claimed invention may be quite instructive. The presently claimed invention relates to a processing aid for a thermoplastic resin, the processing aid being obtained by multi-step emulsion-

polymerization of a composition which consists essentially of a specific (meth)acrylate, another alkyl acrylate and, optionally, another vinyl monomer copolymerizable therewith, in the presence of a polymerization initiator. The obtained processing aid has a particle structure as it is obtained by emulsion-polymerization. In addition, the processing aid, since it is obtained by multi-step emulsion polymerizing as described in Claim 1, has a core-shell structure. The processing aid of the present invention as obtained by multi-step emulsion polymerization of the above monomers provides a processing aid which yields excellent processability, in particular, provides properties such as a peeling property from a metal surface at a high temperature. It is submitted that such a processing aid is not taught or suggested by the cited patent to Orikasa et al.

More particularly, it is submitted that the processing aid for thermoplastic resin according to the presently claimed invention and the copolymer of the Orikasa et al patent are completely different in their structures. The Orikasa et al patent discloses that the epoxy group-containing olefin copolymer may be prepared "by simultaneously or stepwise in the presence of 0.0001 to 1% by weight of a radical polymerization initiator based on the total weight of all the monomers at a polymerization pressure of 500 to 4,000 kg/cm<sup>2</sup> at a reaction temperature of 50°C to 400°C, using a chain transfer agent and, if necessary, some auxiliaries in an autoclave or tubular reactor." This reaction method is a bulk polymerization or liquid phase bulk polymerization. Therefore, the epoxy group-containing olefin copolymer according to the Orikasa et al patent is obtained in a liquid resin state and

thus does not have a particle structure.

In distinct contrast, the processing aid in accordance with the presently claimed invention is prepared by multi-step emulsion-polymerization where the obtained polymer is in a latex and has a particle structure because the polymerization is conducted in water solvent. The obtained latex, wherein the above polymer is colloiddally dispersed in the water solvent, has a particle diameter at most of about 0.5  $\mu\text{m}$ . In the case that an epoxy group-containing olefin copolymer is dispersed in water solvent, the particle diameter may usually be 10  $\mu\text{m}$  to several hundreds  $\mu\text{m}$ . Consequently, the particle diameter is different from the one obtained by emulsion polymerization.

By conducting the emulsion polymerization in multi-step in accordance with the present invention, a polymer particle having a multi-phase particle structure designated as a core-shell structure can be obtained. As described above, the copolymer obtained in accordance with the Orikasa et al patent is a liquid resin. Inasmuch as the processing aid of the presently claimed invention has a particle structure, the polymeric processing aid of the invention and polymer according to the Orikasa et al patent are entirely different in their structure.

The above distinctions are supported by a comparison of the present invention with the Orikasa et al patent based on their respective Examples. In preparation Example 1 in

the Orikasa et al patent which was specifically cited in the rejection, preparation of a multi-phase structure thermoplastic resin (III) comprising a copolymer of an epoxy group-containing olefin copolymer and a (co)polymer of a vinyl and one of the (co)polymers forms the dispersion phase having a specific particle diameter is disclosed. More specifically, the epoxy group-containing polymer first is suspended in water by stirring. A radical polymerization initiator and a solution, where a radical polymerizable or copolymerizable organic peroxide is dissolved in 300g of styrene, is added to the suspension, and then the solution is impregnated with epoxy group-containing olefin copolymer and polymerized to yield graft precursor (IIIa'). Thereafter, multi-phase structure thermoplastic resin (III) is obtained by a graft reaction in an extruder under high temperature. In preparation Example 2 according to the Orikasa et al patent, 300g of methyl methacrylate is used instead of styrene and n-dodecylmercaptan is used (graft precursor (IIIb')).

It was asserted in the Action that the graft precursor (IIIb') corresponds to the processing aid of the presently claimed invention. While the graft precursor (IIIb') is prepared by a multi-step procedure, it is not obtained by emulsion-polymerization however. Therefore, the obtained copolymer differs in structure from the processing aid according to the present invention.

In addition to the above distinctions, it is to be emphasized that the processing aid for thermoplastic resin as now defined by amended claim 1 is obtained by multi-step

emulsion-polymerizing a composition consisting essentially of 0.1 to 5% by weight of a (meth)acrylate having an oxygen atom in addition to an ester bond, 10 to 99.9 % by weight of another alkyl acrylate, and 0 to 89.9 % by weight of another vinyl monomer copolymerizable therewith, in the presence of an organic peroxide having a tertiary-butyl peroxy group as a polymerization initiator. In distinct contrast thereto, the copolymer according to the cited Orikasa et al patent mainly contains ethylene (60 to 99% by weight), so it is clear that the composition of the patent is completely different from that of the presently claimed invention.

It is submitted that these differences are significant. A processing aid having an amount of an alkyl acrylate, an essential component of the presently claimed invention, which is outside of the range as recited in claim 1, has a poor roll peeling property as demonstrated by Comparative Examples 3, 6, 29 and 33. It is easily expected that the composition as disclosed in the Orikasa et al patent would not have an excellent peeling property from a metal surface at a high temperature as does the presently claimed invention.

For the reasons stated above, withdrawal of the rejection under 35 U.S.C. § 102(b) and allowance of claims 1, 3 and 6 as amended over the cited Orikasa et al patent are respectfully requested.

Claims 1, 3 and 6 were rejected under 35 USC § 102(b) as being anticipated, or in the alternative, under 35 USC § 103(a), as being unpatentable over the patent to Kato et al. In making this rejection, it was asserted that the cited Kato et al patent teaches a composition which is formed in a multi-step polymerization from components which meet the recitations of independent claim 1 by teaching (1) glycidyl methacrylate and (2) butyl methacrylate. Reconsideration of this rejection in view of the above claim amendments and the following comments is respectfully requested.

It is submitted that the cited patent to Kato et al does not teach or suggest the processing aid as defined by amended claim 1. More particularly, the Kato et al patent relates to an impact-resistant methyl methacrylate resin obtained by polymerizing methyl methacrylate in the presence of an ethylene copolymer containing epoxy group. In Example 1 of the Kato et al patent which was specifically cited in the Action, an ethylene copolymer containing an epoxy group was obtained by (1) charging ditert-butyl peroxide, glycidyl methacrylate and butyl acrylate into a high pressure reactor, (2) introducing ethylene into the reactor and (3) starting the reaction at 150°C under a pressure of 1500 kg/cm<sup>2</sup>. Subsequently, methyl methacrylate was polymerized using the above-obtained ethylene copolymer, the ethylene copolymer was brought into solution by immersing the flask in an oil bath, and methyl methacrylate containing dodecyl mercaptan and benzoyl peroxide dissolved therein was added to the flask, followed by addition of an aqueous solution comprising water, sodium phosphate etc. Then, the mixture was polymerized by

suspension or emulsion polymerization to yield methyl methacrylate.

Thus, the disclosed process of the Kato et al patent for preparing ethylene copolymer containing epoxy group is a bulk polymerization as in the Orikasa et al patent. As discussed above with reference to the Orikasa et al patent, once the liquid resin is prepared by bulk polymerization, it is difficult to disperse in water with a particle diameter of at most 0.5  $\mu\text{m}$ . Therefore, the resin disclosed in the Kato patent is also different from the one obtained by multi-step emulsion polymerization as presently claimed even though the resin obtained in multi-step procedure. Consequently, it is submitted that the processing aid in accordance with the presently claimed invention and the copolymer according to the Kato patent differ at least in terms of particle diameter of the obtained products and in terms of their structures.

For the reasons stated above, withdrawal of the rejections under 35 U.S.C. § 102(b) and § 103(a) and allowance of claims 1, 3 and 6 over the cited Kato et al patent are respectfully requested.

Claims 9 and 11 were rejected under 35 USC § 103(a) as being unpatentable over the patents to Orikasa et al or Kato et al in view of the newly cited patent to Robinson et al. In making this rejection, it was asserted that the cited Orikasa et al and Kato et al patents teach a composition as discussed above, it being acknowledged that neither of

these patents teach mercaptans having an ester group as chain transfer agents. Reliance was then made on the newly cited patent to Robinson et al for allegedly teaching a mercaptan chain transfer agent as recited in claim 9. Reconsideration of this rejection in view of the above claim amendments and the following comments is respectfully requested.

Again, before discussing the subject rejection in detail, a brief review of the presently claimed invention as set forth in may be quite instructive. The above remarks relative to the invention as defined by independent claim 1 are reiterated herein. In accordance with the inventions as defined by claims 9 and 11, a processing aid providing an excellent roll peeling property can be obtained by using a mercaptan containing an alkyl ester group having C<sub>4-20</sub> alkyl group as a chain transfer agent. In this regard, attention is directed to the composition of Example 8, which satisfies claims 9 and 11, where the roll peeling property is considerably improved to a value of 10. In distinct contrast, the compositions of Comparative Examples 8 and 9, where tert-dodecyl mercaptan and n-dodecyl mercaptan, which do not satisfy claims 9 and 11, are used, the roll peeling properties only have a value of 5. From this comparison, it is evident that the compositions of the presently claimed invention have an excellent roll peeling property. Thus, the processing aid of the presently claimed invention has excellent processability and, in particular, provides excellent properties such as a peeling from a metal surface at a high temperature. It is submitted that such a processing aid is not taught or suggested by the



cited patents, whether taken singly or in combination.

The above remarks relative to the teaching deficiencies of the Orikasa et al and Kato et al patents are reiterated with regard to this rejection. It is submitted that the patent to Robinson et al does not supply these teaching deficiencies.

More particularly, the Robinson et al patent relates to aqueous thickeners for a wide variety of aqueous systems. As a consequence, these thickeners are in a completely different technical field from the processing aids for thermoplastic resins of the presently claimed invention as well as the compositions according to the Kato et al the Orikasa et al patents. Furthermore, the Robinson patent, which does not relate to a processing aid, contains no teaching or suggestion that a peeling property from a metal surface at a high temperature can be improved by using mercaptan having a specific structure. Therefore, it is submitted that one of ordinary skill in the art would not look to achieve the presently claimed invention from any combination of the Kato et al, Orikasa et al and Robinson et al patents.

For the reasons stated above, withdrawal of the rejection under 35 U.S.C. § 103(a) and allowance of claims 9 and 11 over the cited patents are respectfully requested.

In view of the foregoing, it is submitted that the subject application is now in

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condition for allowance and early notice to that effect is earnestly solicited.

In the event this paper is not timely filed, the undersigned hereby petitions for an appropriate extension of time. The fee for this extension may be charged to Deposit Account No. 01-2340, along with any other additional fees which may be required with respect to this paper.

Respectfully submitted,

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